SONY

3-800-228-11(1)

*SMO-F531*

# *Magneto-Optical Disk Drive*

**Edition 1**

**Technical Guide and Specifications**

# SAFETY REGULATIONS

## Owner's Record

The model and serial numbers are located on the top of the drive. Record these numbers in the spaces provided below. Refer to them whenever you call upon your sales representative regarding this product.

Model No. SMO-F531 Serial No. _____

## Information

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment.

Note: This equipment generates, uses and can radiate radio frequency energy and may cause harmful interference to radio communications in spite of a particular installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment dose cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try correct the interference by one more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

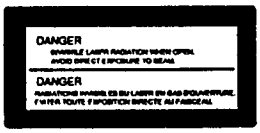
## WARNING

**To prevent fire or shock hazard, do not expose the unit to rain or moisture.**

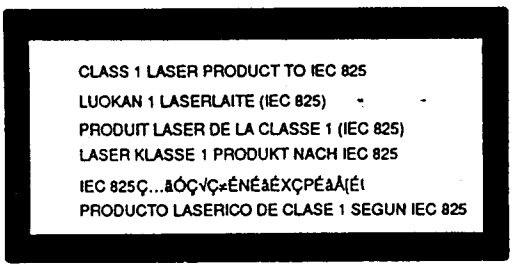
**To avoid electrical shock, do not open the cabinet. Refer servicing to qualified personnel only.**

**CAUTION**

As the laser beam used in the SMO-F531 is harmful to the eyes, do not attempt to disassemble the unit. Refer servicing to qualified personnel only.




This label is affixed both on the top cover and, internally, on the cartridge tray of this unit.


CLASS 1 LASER PRODUCT TO IEC 825
LUOKAN 1 LASERLAITE (IEC 825)
PRODUIT LASER DE LA CLASSE 1 (IEC 825)
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PRODUCTO LASERICO DE CLASE 1 SEGUN IEC 825

This MO disk unit is classified as a CLASS 1 LASER PRODUCT.

The CLASS 1 LASER PRODUCT label is located at the top cover of the unit.

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# REFERENCES

- SMO-F531 SCSI Specification.
- Small Computer System Interface (SCSI-1), ANSI X3.131-1986.
- Common Command Set of the Small Computer System Interface (SCSI) ANSI X3T9.2-85-82 (rev. 4B )
- Small Computer System Interface (SCSI-2) ANSI Draft Rev. 10h
- ISO/IEC 10089 : 1991 (E), Format A, 130 mm rewritable Optical Disk Cartridges for Information Interchange.
- ISO/IEC 13549 Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1.3 Giga-bytes per Cartridge -

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# ORGANIZATION

This publication contains information about the Sony SMO-F531 Magneto-Optical Disk Drive. This publication is divided into the following sections.

■ **Chapter 1. INTRODUCTION**

This chapter contains a general overview of the SMO-F531, touching upon its features, and the location and function of its parts.

■ **Chapter 2. INSTALLATION**

This chapter contains information how to set up the functions and ID address.

■ **Chapter 3. SPECIFICATIONS**

In this chapter, performance data and environmental, electrical and physical specifications are provided .

■ **Chapter 4. HARDWARE DESCRIPTION**

Explained in this chapter is the detailed description of the drive's block diagram, electronics and mechanism.

■ **Chapter 5. HOST INTERFACE**

This chapter provides the information about the data bus signal lines, diagnostics and SCSI command summary.

■ **Chapter 6. MEDIA FORMAT**

This chapter contains media format specification and defect management.

■ **Chapter 7. PRECAUTIONS**

Described in this chapter is precautions regarding use and operation of the SMO-F531, and the magneto-optical disk cartridges. Also explained in this chapter is the proper cleaning method of drive's lens and disks.

■ **APPENDIX**

The appendix contains mechanical dimensions, packaging form.

# Chapter 1. INTRODUCTION

## Scope

The Sony SMO-F531 is a magneto-optical disk drive. It accepts a 5 1/4 inch (130 mm) erasable magneto-optical disk conforming to ISO/IEC 13549:1994 (type R/W and type WO), ISO/IEC 10089:1991 Format A (rewritable) and ISO/IEC 11560:1992 (write once).

The SMO-F531 can record data on 1.3 gigabytes Type R/W (fully rewritable disks), type WO (write once disks), 650 megabytes rewritable and write-once magneto-optical cartridges. Since the disk cartridge is removable, the SMO-F531's store capacity is virtually unlimited. Such a removable medium is advantageous not only for its portability but also for security because each disk cartridge can be safely locked up. Information stored in a disk can be achieved for at least fifteen years without requiring any kind of maintenance.

Unlike the conventional WORM optical disk drives taking the all-optical approach, the SMO-F531 takes the magneto-optical approach to offer a write-once mode in addition to its erasable capacity. The SMO-F531 identifies the media type of the inserted optical disk, whether it is erasable or write-once, by checking the special codes recorded on each disk at the factory. The drive then invokes the appropriate drive command set for the target disk.

The SMO-F531's write-once mode is suitable for recording data which must not be erased. Data recorded on a write-once optical disk is protected by multiple-level safeguard schemes. For example, the SMO-F531's write-once command set does not support destructive instructions such as *erase* and *format* so that the data stored in the disk can not be wiped out.

The SMO-F531 communicates with a host system via SCSI (Small Computer System Interface) which complies with ANSI X3.131-1986, the Common Command Set (CCS) Rev. 4B and SCSI-2 Rev. 10h.

For its embedded SCSI, the SMO-F531 uses a suite of new LSIs which have greatly contributed to the down-sizing of the drive, and helped accomplish a high degree of reliability. The drive also incorporates 4 Mbytes of buffer memory which enables a high speed burst transfer through SCSI.

# Features

- Magneto-optical technology enables data to be written on the disk and erased over and over again.
- Using the EDM-1300 (1,024 bytes/sector) disk, the SMO-F531 can store 1.3 Gbytes of formatted data. The capacity of EDM-1301 (512 bytes/sector) disk is up to 1.2 Gbytes.
- To assure compatibility regardless of manufacturer, the disks conform to ISO/IEC 13549:1994 (type R/W and type WO).
- In addition to the double-density media, the SMO-F531 can read and write the former standard capacity(650 MB) rewritable and write-once disks. There is no need for re-recording or re-formatting. The SMO-F531 offers a built-in capability for automatically differentiating the media types and operates appropriately.
- Any disk conforming to the internationally accepted CCS (continuous/ composite servo) format standard can be used in the drive.
- Industry-standard both SCSI-1 and SCSI-2 interface can allow immediate connection to a wide choice of computers.
- The 3,600 $min^{-1}$(rpm) high-speed spindle motor enables data transfer rates of up to 2.4 Mbytes/sec (1,024 Bytes/sector) and 2.16 Mbytes/sec (512 bytes/ sector).
- 5 1/4 inch half height form factor.
- High reliable mechanism and newly developed LSIs realize the MTBF of exceeding 100,000 POH and the load/unload durability of 500,000 cycles or more.
- 4 Mbytes buffer memory for read ahead and write back caching.
- Lightweight optical head of the split optics can be less than 39 msec of average seek time.
- Low power consumption 12.2 W (typical).

# System Overview

This section provides general description of the SMO-F531 magneto-optical disk drive.

## Front View

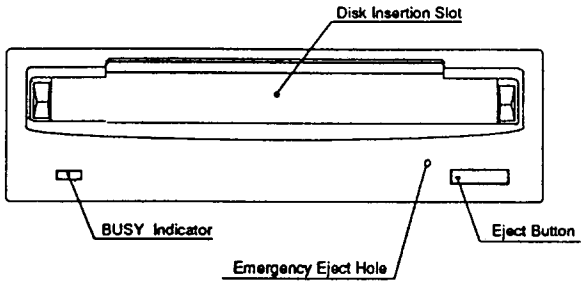



**Fig. 1.1 : Front View**

■ **Disk Insertion Slot**

Insert the disk cartridge into this slot.

■ **BUSY Indicator**

The indicator lights up when the drive is accessing or writing data. Do not eject the disk cartridge when this indicator is lit.

■ **Emergency Eject Hole**

When the disk cartridge cannot be ejected using the EJECT button or software commands, insert the supplied emergency eject tool into this hole to eject the cartridge. Do not attempt to use the emergency tool during power on.

■ **Eject Button**

Press this button to eject the disk cartridge from the drive. You can also eject the cartridge using software command on the host computer. The SMO-F531 suspends ejection of disk cartridge while it executes a SCSI command or while it holds data to be flush in the cache buffer. Note that this Eject button is disabled when the "Lock Cartridge" software command had been issued from the host system. Do not eject the disk cartridge when the BUSY indicator is lit.

## Rear View

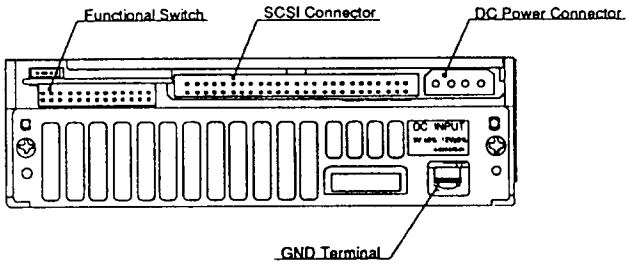



**Fig. 1.2 : Rear View**

### ■ Functional Switch

A 20-pin header socket jumper block is used for setting the SCSI drive number and other configurations. See "Functional Switch Settings" section for more information.

### ■ SCSI and DC Power Connector

A standard 50-pin SCSI connector is used for connection with the host system. A 4-pin DC voltage power supply connector is included in SCSI and DC Power Connector. See "SCSI and DC Power Connector" section for more information.

### ■ GND Terminal

The drive's ground outlet.

# Chapter 2. INSTALLATION

Before setting up the SMO-F531 magneto-optical disk drive, be sure to check to see that all of required components and accessories are included.

## Component and Accessory Check List

Upon opening the carton, check to see that all of components and accessories listed below are provided.

- SMO-F531 Magneto-Optical Disk Drive
- Emergency Eject Tool
- Short Socket for Functional Switch (5 pcs)

## Installation Requirements

This section provides information regarding the installation of the SMO-F531 Magneto-Optical Disk Drive.

### Location Requirements

The SMO-F531 must be placed in a well-ventilated area, ideally in an air-conditioned room. The temperature should be between 5 to 45 °C (41 to 113 °F) and relative humidity between 10 to 90 %.

The SMO-F531 may be placed horizontally or vertically on a flat, stable surface. The maximum permissible mounting tilt is less than or equal to 10 degrees from the other end of the drive.

Neither the drive nor the disk cartridge should be placed in a location subject to dust, vibration or shock. Any place close to a strong magnetic field must be avoided. Since moisture condensation may cause serious problems for both

the drive and the disk cartridge, special care must be taken to avoid sudden changes in temperature and/or humidity.

The drive must not be moved with a disk cartridge inserted.

## Cooling Requirements

Forced-air cooling is required through the drive, and prevents from overheating of the mechanism and electronics residing in the drive. Forced-air cooling must be provided as an integral part of the system package.

This maximum temperature is applicable to all operating conditions specified in this manual.

| Measuring Point | Maximum Temperature |
|---|---|
| Disk Cartridge | 55 °C (131 °F) |

NOTE

To meet the temperature conditions, the system should include a fan free-air capacity .

**The temperature conditions specified in this manual must always be met for the SMO-F531 to function properly.**

## Temperature Alarm

Excessive internal temperature may cause the drive to stop functioning. In case of overheating of the drive inside (exceeding 62 ± 3 °C), the BUSY indicator lamp flashes on and off at 1.3-second intervals and the drive returns Temperature Alarm error message (Sense key: 4H, ASC: 83H). Improve the ventilation for the drive.

# Functional Switch Settings

The functional switch is located in the upper left corner of the SMO-F531 as seen from the rear. This switch is used for setting the SCSI drive number and other configurations as shown in the table below. See "SCSI Terminator" for information regarding termination.

The SMO-F531 uses a 26-pin male header socket, Fujitsu part number FCN-728P026-L/C or equivalent header socket, and is designed for use with 26-pin female connector, Fujitsu part number FCN-607B026-G/D or equivalent.

Recommend jumper socket : IMSA-9215H-GF (IRISO Electronics Co. Ltd.)

### WARNING

With write caching enabled, data integrity of the information in the buffer menory is not guaranteed through power cycling.

**Fig. 2.1 : Functional Switch**

Table 2.1 : Functional Switch Signal Allocation

| | | | |
|---|---|---|---|
| A1 | SCSI ID(0) | B1 | GROUND |
| A2 | SCSI ID(1) | B2 | GROUND |
| A3 | SCSI ID(2) | B3 | GROUND |
| A4 | SCSI Parity | B4 | GROUND |
| A5 | Reserved | B5 | GROUND |
| A6 | Write Cache Control | B6 | GROUND |
| A7 | Manual Eject | B7 | GROUND |
| A8 | SCSI-1/SCSI-2 | B8 | GROUND |
| A9 | Terminator | B9 | GROUND |
| A10 | Terminator Power from PCB | B10 | Terminator Power to Connector |
| A11 | Spin-up Mode | B11 | GROUND |
| A12 | Reserved | B12 | GROUND |
| A13 | Command Eject | B13 | GROUND |

**Table 2.2 : Switch Setting Assignments**

<table>
<tr><th>Switch</th><th>Function</th><th>Factory setting</th></tr>
<tr><td>1, 2, 3</td><td>SCSI ID
<table>
<tr><th rowspan="2">ID</th><th colspan="3">Switch</th></tr>
<tr><th>3</th><th>2</th><th>1</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>1</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>2</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>3</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>4</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>5</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>6</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>7</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table></td><td>ID=0<br>1: OFF<br>2: OFF<br>3: OFF</td></tr>
<tr><td>4</td><td>SCSI Parity Check<br>OFF: Enabled<br>ON: Disabled</td><td>OFF</td></tr>
<tr><td>5</td><td>Do not change this setting</td><td>OFF</td></tr>
<tr><td>6</td><td>Write Cache Control<br>OFF: Write cache enabled<br>ON: Write cache disabled</td><td>OFF</td></tr>
<tr><td>7</td><td>Manual Eject Mode Selection<br>OFF: Manual eject enabled<br>ON: Manual eject disabled</td><td>OFF</td></tr>
<tr><td>8</td><td>SCSI Mode<br>OFF: SCSI-2<br>ON: SCSI-1</td><td>OFF</td></tr>
<tr><td>9</td><td>SCSI Termination<br>OFF: Internal SCSI termination disabled<br>ON: Internal SCSI termination enabled</td><td>OFF</td></tr>
<tr><td>10</td><td>Setting SCSI Terminator Power<br>OFF: SCSI Terminator power disabled<br>ON: SCSI Terminator power enabled</td><td>OFF</td></tr>
<tr><td>11</td><td>Setting Spin-up Mode<br>OFF: Spin-up by insert the disk cartridge<br>ON: Spin-up by START UNIT command indicated</td><td>OFF</td></tr>
<tr><td>12</td><td>Do not change this setting</td><td>OFF</td></tr>
<tr><td>13</td><td>Command Eject<br>OFF: Command eject enabled<br>ON: Command eject disabled</td><td>OFF</td></tr>
</table>

NOTE

For Example, "Switch 4 = ON" signifies a jumper is placed over pins A4 and B4. "OFF" means that no jumper is placed over the corresponding pin numbers(both A and B rows). 5 pcs of jumper sockets are supplied with the drive.

# SCSI and DC Power Connector

The SCSI and DC power connector is located in the upper part of the SMO-F531 as seen from the rear.

The SMO-F531 uses a 50-pin and 4-pin male header socket, Fujitsu part number, FCN-748Q050-L/ZZ-21. This connector is designed for use with a 3M type number 7950-6500 female connector for 50-pin and MATE-N-LOCK female connector plug AMP type number 1-480424-0.

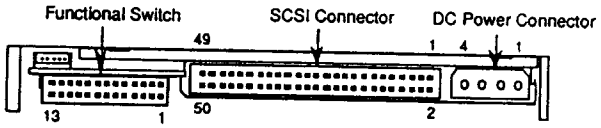



Fig. 2.2 : SCSI and DC Power Connector

Table 2.3 : Pin Assignments of DC Power Connector

| Pin No. | Voltage |
|---|---|
| 1 | DC +12 V (±5 %) |
| 2 | 12V Return |
| 3 | 5V Return |
| 4 | DC +5 V (±5 %) |

Table 2.4 : Pin Assignments of SCSI Connector

| Signal Name | Pin No. | | Signal Name |
|---|---|---|---|
| GND | 1 | 2 | $\overline{DB0}$ |
| GND | 3 | 4 | $\overline{DB1}$ |
| GND | 5 | 6 | $\overline{DB2}$ |
| GND | 7 | 8 | $\overline{DB3}$ |
| GND | 9 | 10 | $\overline{DB4}$ |
| GND | 11 | 12 | $\overline{DB5}$ |
| GND | 13 | 14 | $\overline{DB6}$ |
| GND | 15 | 16 | $\overline{DB7}$ |
| GND | 17 | 18 | $\overline{DBP}$ |
| GND | 19 | 20 | GND |
| GND | 21 | 22 | GND |
| GND | 23 | 24 | GND |
| OPEN | 25 | 26 | (TERM PW) |
| GND | 27 | 28 | GND |
| GND | 29 | 30 | GND |
| GND | 31 | 32 | $\overline{ATN}$ |
| GND | 33 | 34 | GND |
| GND | 35 | 36 | $\overline{BSY}$ |
| GND | 37 | 38 | $\overline{ACK}$ |
| GND | 39 | 40 | $\overline{RST}$ |
| GND | 41 | 42 | $\overline{MSG}$ |
| GND | 43 | 44 | $\overline{SEL}$ |
| GND | 45 | 46 | $\overline{C/D}$ |
| GND | 47 | 48 | $\overline{REQ}$ |
| GND | 49 | 50 | $\overline{I/O}$ |

The bar " — " above the signal indicates active low.

## SCSI Terminator

The SMO-F531 has an internal SCSI bus terminator. When the drive is used as the last device on the SCSI chain, enable Switch No.9 (TERMINATOR) of the Functional Switch. Otherwise, the user is responsible for proper termination and powering of the SCSI bus in the system.

For a single ended cable, a 50-signal conductor flat cable or a 25-signal twisted cable can be used. The cable should not be longer than 6.0 meters.

# Chapter 3. SPECIFICATIONS

## Drive Specifications

This section provides the complete information of the SMO-F531.

**Table 3.1 : Drive Specifications (1)**

(used EDM-1300/1301)

| Item | Specification | Remarks |
|---|---|---|
| Disk | 130 mm double sided MO Disk | with a cartridge |
| Formatted Address | Track 0 Sector 0 to Track 37,599 Sector 16 | 1,024 bytes/sector |
| | Track 0 Sector 0 to Track 37,599 Sector 30 | 512 bytes/sector |
| Capacity | | 1 M = $10^6$, 1 G = $10^9$ |
| Formatted per disk | 1.304 Gbytes | 1,024 bytes/sector |
| | 1.191 Gbytes | 512 bytes/sector |
| per side | 652.3 Mbytes | 1,024 bytes/sector |
| | 595.6 Mbytes | 512 bytes/sector |
| Disk Format | Continuous/Composite | complied with ISO/IEC13549, ECMA-184 |
| Rotational Mode | ZCAV | ZCAV: Zoned Constant Angular Velocity |
| Bytes per Sector | 1,024 or 512 | |
| Sectors per Track | 17 or 31 | Per Logical Track |
| Total Tracks per Side | 37,600 | Logical Tracks |
| | 21,600 | Physical Tracks |
| Host Interface | SCSI-1 | complied with ANSI X3.131-1986 |
| | SCSI-2 | complied with ANSI Draft Rev.10h |
| Data Transfer Rate | | |
| User Data Transfer Rate | 1.24 to 2.40 Mbytes/s (max.) | 1,024 bytes/sector |
| | 1.13 to 2.16 Mbytes/s (max.) | 512 bytes/sector |
| Burst Transfer Rate | 5 Mbytes/s (max.) | Synchronous |
| | 3 Mbytes/s (max.) | Asynchronous |
| Data Error Rate | Bit Error Rate less than $10^{-12}$ | using ECC and alternative processing capacity |
| Error Correction Length | 80 bytes (max.) | 1,024 bytes/sector |
| | 40 bytes (max.) | 512 bytes/sector |
| Spare Block | 2,057 sectors (max.) | 1,024 bytes/sector |
| | 2,077 sectors (max.) | 512 bytes/sector |

Table 3.2 : Drive Specifications (2)

| Item | Specification | Remarks |
|---|---|---|
| Buffer Memory Capacity | 4 Mbytes | |
| Rotation Speed | 3,600 $min^{-1}$ (rpm) | |
| Average Latency | 8.3 ms | |
| Loading Time *1 | 5.5 s (typ.) | including spin-up time |
| Spin-up Time *1 | 2.5 s (typ.) | |
| Unloading Time *1 | 3.5 s (typ.) | including spin-down time |
| Spin-down Time *1 | 2.2 s (typ.) | |
| Bias Magnet Switching Time | 5 ms (typ.) | |
| Modulation Code | RLL (2,7) | |
| Seek Time *1 | | Measured at SCSI level |
| Single Track | 5 ms (typ.) | excluding SCSI communication overhead |
| Average | 39 ms (typ.) | |
| Full Stroke | 70 ms (typ.) | |
| DC Voltage | +5 V ± 5% | Ripple voltage < 50 mVpp |
| | +12V ± 5% | Ripple voltage <100 mVpp |
| Power Consumption | 12.2W (typ.) | |
| Current Consumption +5V | 1.0 A (typ.), 1.5 A (max.) | |
| +12V | 0.6A (typ.), 2.5 A (max.) | |
| Power Supply Delay (Sequencing) | ≤ 0.5 s | 90% of the final value for both *2 power-on and power-off. |

*1 Including controller overhead
*2 Refer to the below chart

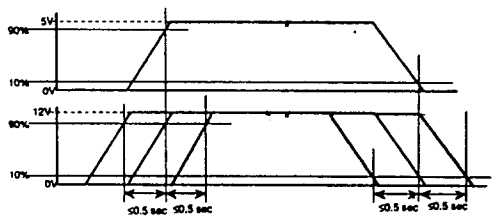


**Table 3.3 : Drive Specifications (3)**

| Item | Specification | Remarks |
|---|---|---|
| Dimension (H x W x D) | 41.4 x 146.0 x 203.2 mm<br>(1.63 x 5.75 x 8.00 inch) | without front panel, without projection |
| Weight | 1.7 kg (3 lb 12 oz) | without cartridge |
| Mounting | Horizontal or Vertical | |
| Tilt | < ± 10° | |
| Laser Diode | | |
| Type | Semiconductor Laser | GaAlAs |
| Wavelength | 785 ± 10 nm | |
| Output Power | 35 mW (max.) | |
| Environmental | | |
| Operating | | |
| Temperature | 5 to 45 °C (41 to 113°F) | See "Cooling Requirements". |
| Relative Humidity | 10 to 90 % | Not condensing |
| Max. Wet-bulb Temp. | 29 °C (84.2°F) | |
| Temperature Gradient | 10 °C/hour (18 °F/hour) | |
| Non-operating | | No disk |
| Temperature | -30 to 60 °C (-22 to 140 °F) | |
| Relative Humidity | 5 to 90 % | Not condensing |
| Vibration | | PSD: Power Spectrum Density |
| Operating | f: 5 to 350 Hz PSD: 0.014 $m^2/s^3$ ($0.00015G^2/Hz$)<br>f: 350 to 500 Hz -6 dB/Oct<br>f: 500 Hz PSD: 0.0096 $m^2/s^3$ ($0.0001 G^2/Hz$) | No customer perceivable error |
| Non-Operating | f: 5 to 100 Hz PSD: 1.92 $m^2/s^3$ ($0.02 G^2/Hz$)<br>f: 100 to 137 Hz -6 dB/Oct<br>f: 137 to 350 Hz PSD: 1.03 $m^2/s^3$ ($0.0107 G^2/Hz$)<br>f: 350 to 500 Hz -6 dB/Oct<br>f: 500 Hz PSD: 0.50 $m^2/s^3$ ($0.0052 G^2/Hz$) | No permanent damage |
| Shock | | |
| Operating | 294 $m/s^2$ (30 G), 3 ms half sine wave | No data loss |
| Non-Operating | 873 $m/s^2$ (89 G), 3 ms half sine wave | No permanent damage |

These signals signify as follows:

**BUSY (BSY)**

An "OR-tied" signal that indicates whether the bus is being used.

**SELECT (SEL)**

A signal used either by the initiator to select a target or by a target to reselect an initiator.

**CONTROL/DATA (C/D)**

A signal driven by a target that indicates whether CONTROL or DATA information is on the DATA BUS. True indicates CONTROL.

**INPUT/OUTPUT (I/O)**

A signal driven by a target that controls the direction of data flow on the DATA BUS with respect to an initiator. True indicates input to the initiator. This signal is also used for distinction between SELECTION and RESELECTION phases.

**MESSAGE (MSG)**

A signal driven by a target during the MESSAGE phase.

**REQUEST (REQ)**

A signal driven by a target to indicate a request for an REQ/ACK data transfer handshake.

**ACKNOWLEDGE (ACK)**

A signal driven by the initiator to indicate an acknowledgement for an REQ/ACK data transfer handshake.

**ATTENTION (ATN)**

A signal driven by an initiator to indicate the ATTENTION condition.

**RESET (RST)**

A "OR-tied" signal that indicates the RESET condition.

Followings are SMO-F531 drive specification using 650 MB/594 MB disk. Remaining specifications are same as Drive Specifications (1) to (4).

**Table 3.5 : Drive Specifications (5)**

(used EDM-1DA0/1DA1)

| Item | Specification | Remarks |
|---|---|---|
| Disk | 130 mm double sided MO Disk | with a cartridge |
| Formatted Address | Track 0 Sector 0 to Track 18,750 Sector 16 | 1,024 bytes/sector |
| | Track 0 Sector 0 to Track 18,750 Sector 30 | 512 bytes/sector |
| Capacity | | 1 M = $10^6$ |
| Formatted per Disk | 644.2 Mbytes/disk | 1,024 bytes/sector |
| | 590.8 Mbytes/disk | 512 bytes/sector |
| per Side | 322.1 Mbytes/side | 1,024 bytes/sector |
| | 295.4 Mbytes/side | 512 bytes/sector |
| Disk Format | Continuous/Composite | complied with ISO/IEC 10089 format A |
| Rotational Mode | CAV | CAV: Constant Angular Velocity |
| Bytes per Sector | 1,024 or 512 | |
| Sectors per Track | 17 or 31 | |
| Total Tracks per Side | 18,751 | |
| Data Transfer Rate | | |
| User Data Transfer Rate | 1.04 Mbytes/s (max.) | 1,024 bytes/sector |
| | 0.95 Mbytes/s (max.) | 512 bytes/sector |
| Burst Transfer Rate | 5 Mbytes/s (max.) | Synchronous |
| | 3 Mbytes/s (max.) | Asynchronous |
| Spare Block | 2,048 sectors (max.) | |
| Rotation Speed | 3,600 $min^{-1}$ (rpm) | |

# Chapter 4. HARDWARE DESCRIPTION

The SMO-F531 magneto-optical disk drive consists of several mechanical blocks, electrical blocks, SCSI control blocks, and an optical block. The electrical blocks contain all the analog and digital circuits required for various driving functions. The anusialog circuitry includes the laser diode drive, RF block and servo systems for focng and tracking. The digital circuitry includes analog and mechanical control logics, modulator/demodulator, drive interface logic and SCSI control block.

For connection with a host system, the SMO-F531 uses the SCSI (Small Computer System Interface) which complies with ANSI DRAFT Rev.10h, ANSI X3.131-1986 and the CCS (Common Command Set) Rev.4B. The drive uses the LDC (Long Distance Code) for error detection and correction as described in the "Data Field Format" section.

Figure 4.1 shows the drive's block diagram.

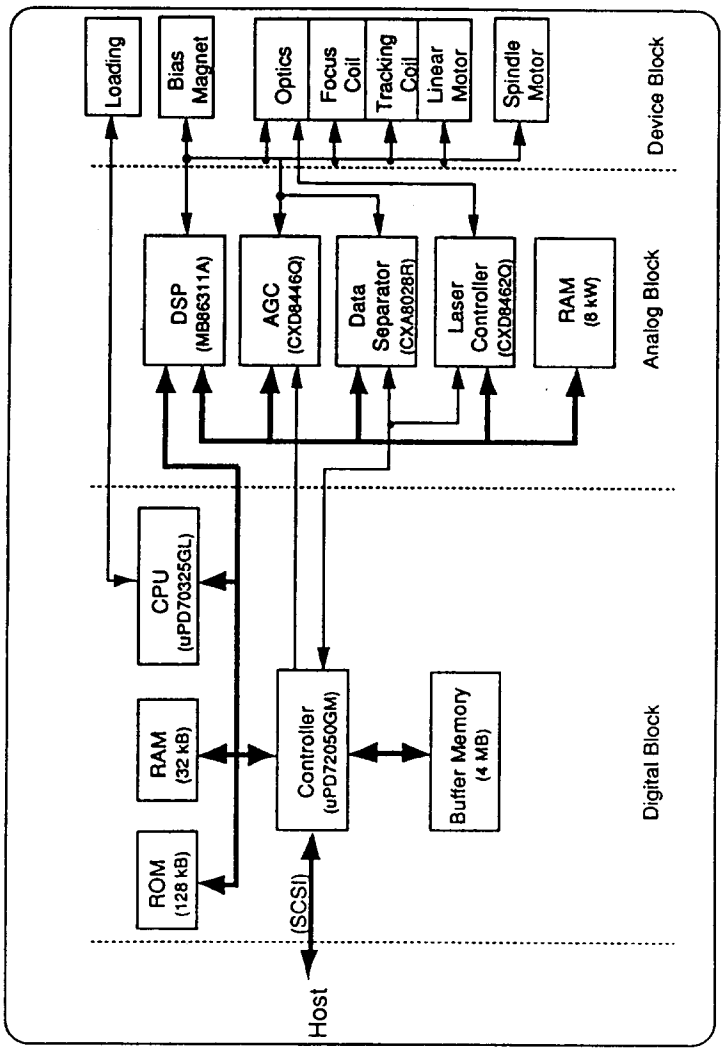



Fig. 4.1: SMO-F531 Block Diagram

## Optical Head

Erasing, writing and reading are performed via a laser diode and photo detectors residing in the optical head housing. The laser diode driver and RF/servo pre-amplifiers are built in this optical head as well.

## Laser Diode Drive Block

This block drives the laser diode at the correct power in each mode for reading, writing and erasing using an Automatic Power Control (APC) circuit. This circuit measures the read power at ID area, and the write/erase power at the ALPC area in the recording format, and holds these levels.

## Data Separation Block

The read-out signal from the photo-detectors is divided into two different band-width signals for data separation and servo systems. The RF signal is amplified, equalized and differentiated for peak data detection. The PLO (Phase-Locked Oscillator) generates a phase-locked clock in order to separate the data correctly. The demodulator decodes the RLL (2,7) in accordance with this PLO clock.

## Bias Magnet Block

Electrical Magnet is used to generate an erasing bias magnetic field with the polarity opposite to the writing bias polarity.

## Loading Block

The Loading block consists of a loading motor and switches necessary for loading and ejecting a cartridge.

## Microprocessor

The MPU has a 128 KB Program ROM and 32 KB of working RAM on the MPU bus. This module performs the following functions;

(1) Management of SCSI modules
(2) Management of SCSI communication
(3) Control of the drive via the SCSI
(4) Data caching management
(5) Defect management
(6) Error recovery and management
(7) Diagnostic functions.

## DSP/Servo Blocks

The SMO-F531 contains following four servo blocks.

**(1) Spindle Servo**

The spindle servo block rotates the disk at a constant 3,600 $min^{-1}$(rpm) by a digital frequency-lock servo system which uses the Frequency Generator (FG) signal.

**(2) Focus Servo**

The focus servo block controls a two axis actuator to focus the laser diode beam on the disk's writing surface by an astigmatism focus servo system.

**(3) Tracking Servo**

The tracking servo block controls a two axis actuator to follow the track using Sony's own DPP(Differential Push-Pull) servo system.

**(4) Slide Servo**

The slide servo block drives a slide motor(flat linear motor) for accessing the designated track(s) during operations.

These servos are controlled by a Digital Signal Processor Block, consists of DSP 16 kbytes RAM and auto gain control chip. This block supervises the drive and communications with the drive's SCSI block, and controls the analog and mechanical blocks.

## Buffer Memory

Buffer Memory is composed of a 4 Mbytes of DRAM. User data(1024 bytes or 512 bytes) and CRC&ECC etc.(176 bytes or 98 bytes) are stored in both read and write modes.

## Integrated Optical Drive Controller Block

A highly integrated optical drive controller which includes follwing blocks is used in the SMO-F531.

**(1) Buffer Memory Manager**

This module performs the internal data bus management and generates address for Buffer Memory. The data from/to the Buffer Memory is transferred in the DMA mode. The Buffer Memory Manager arbitrates DMA requests according to the priority of each channel.

**(2) SCSI Controller**

The SCSI controller controls the SCSI bus and transfers data from/to the internal bus. This SCSI implementation conforms to ANSI X3T9.2/86-109. User data from/to the Buffer Memory are transferred in the DMA mode.

**(3) ECC Encoder/Decoder**

This module encodes the Read-Solomon Long Distance Code and the CRC during write operations, and generates the syndrome during read operations. It also generates the correction vendor and corrects the data during read operations.

**(4) Drive Interface**

This module performs encoding and decoding of the RLL(2, 7) data and defects the ID data of the disk. The SYNC and RESYNC in the format are encoded and detected in this module.

# Chapter 5. HOST INTERFACE

For connection with a host system, the SMO-F531 uses the SCSI (Small Computer System Interface) which complies with ANSI X3.131-1991(SCSI-2) and ANSI X3.131-1986(SCSI-1). In this section, only a summary of the Sony Magneto-Optical Disk SCSI specification is described. For a detailed explanation of the drive interface, refer to the *SMO-F531 SCSI Specification.*

## Data Bus and Signal Lines

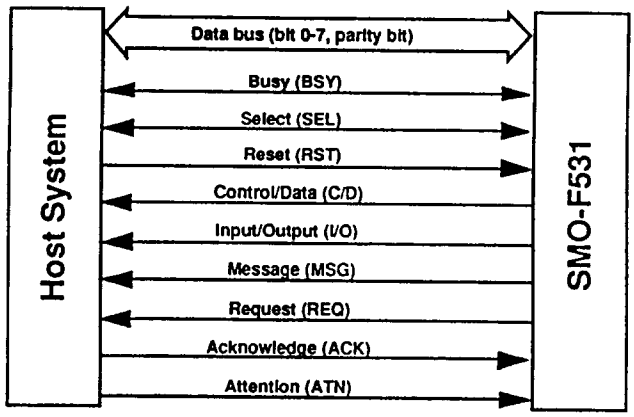



**Fig. 5.1: SCSI Data Bus and Signal Lines**

The SCSI interface uses the 18 signal lines as shown in Fig. 5.1. 9 signals are used for control and the rest for data (Data signals include the parity signal option).

These signals signify as follows:

**BUSY (BSY)**

An "OR-tied" signal that indicates whether the bus is being used.

**SELECT (SEL)**

A signal used either by the initiator to select a target or by a target to reselect an initiator.

**CONTROL/DATA (C/D)**

A signal driven by a target that indicates whether CONTROL or DATA information is on the DATA BUS. True indicates CONTROL.

**INPUT/OUTPUT (I/O)**

A signal driven by a target that controls the direction of data flow on the DATA BUS with respect to an initiator. True indicates input to the initiator. This signal is also used for distinction between SELECTION and RESELECTION phases.

**MESSAGE (MSG)**

A signal driven by a target during the MESSAGE phase.

**REQUEST (REQ)**

A signal driven by a target to indicate a request for an REQ/ACK data transfer handshake.

**ACKNOWLEDGE (ACK)**

A signal driven by the initiator to indicate an acknowledgement for an REQ/ACK data transfer handshake.

**ATTENTION (ATN)**

A signal driven by an initiator to indicate the ATTENTION condition.

**RESET (RST)**

A "OR-tied" signal that indicates the RESET condition.

**DATA BUS(7-0,P) (DB)**

Eight data-bit signals, plus a parity-bit signal form the DATA BUS. DB(7) is the most significant bit and the highest priority during the ARBITRATION phase. Bit number, significance, and priority decrease downward to DB(0). A data bit is defined as ONE when the signal value is true and is defined as ZERO when the signal value is false. Data parity DB(P) is odd.

For the status of the signals relating to control of the drive and details of the timing of the SCSI bus, refer to the ANSI X3T9.2/86-109 and ANSI X3.131-1986(SCSI-1) documents. Single-ended drivers have been adopted for the bus drive. Use a device which satisfies the standards for the driving and receiving circuits.

# Control Method and Procedures

The following flowchart is an example of the procedure for controlling the drive through the SCSI interface. The role of each phase and SCSI command is described in the *SMO-F531 SCSI Specification.*

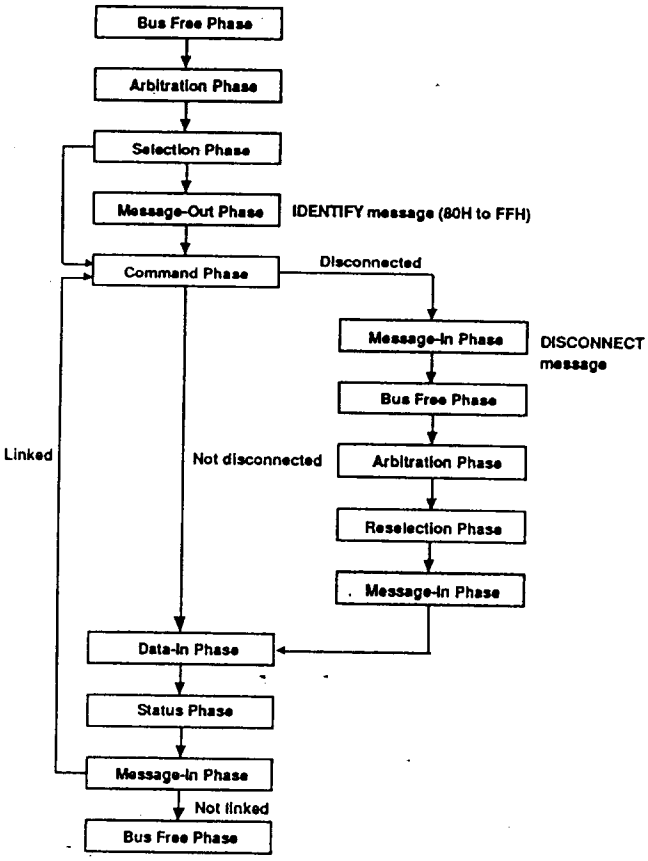


Fig. 5.2: Drive Control Flowchart through SCSI

# Command Summary

## SCSI-2 Commands

The SMO-F531 supports the following group 0, group 1, group 2 and group 5 commands under SCSI-2 operating definition (upper 3 bits of the operation code is called group code).

**GROUP 0 (6-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 00H | TEST UNIT READY | Provide a means to check whether the logical unit is ready. |
| 01H | REZERO UNIT | Move the optical head to the physical track 0. |
| 03H | REQUEST SENSE | Request the detailed error information. |
| 04H | FORMAT UNIT | Initialize the medium. |
| 07H | REASSIGN BLOCKS | Reassign the defective sectors. |
| 08H | READ (6) | Read data from the specified logical block address. |
| 0AH | WRITE (6) | Write data to the specified logical block address. |
| 0BH | SEEK (6) | Move the optical head to the physical track where the specified logical block exists. |
| 12H | INQUIRY | Read the information related to the SMO-F531. |
| 15H | MODE SELECT (6) | Set medium or SMO-F531 parameters. |
| 16H | RESERVE | Gain the exclusive control of a specified logical unit. |
| 17H | RELEASE | Release a specified logical unit from the reservation state. |
| 1AH | MODE SENSE (6) | Read medium and SMO-F531 parameters. |
| 1BH | START/STOP UNIT | Start or stop rotating the medium, and/or eject the medium from the SMO-F531. |
| 1CH | RECEIVE DIAGNOSTIC RESULTS | Request analysis data be sent to the initiator. |
| 1DH | SEND DIAGNOSTIC | Request the SMO-F531 to perform diagnostic tests. |
| 1EH | PREMENT/ALLOW MEDIUM REMOVAL | Prevent or allow removal of the medium in the logical unit. |

**GROUP 1 (10-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 25H | READ CAPACITY | Read the capacity of the medium. |
| 28H | READ (10) | Read data from the specified logical block address. |
| 2AH | WRITE (10) | Write data to the specified logical block address. |
| 2BH | SEEK (10) | Move the optical head to the physical track where the specified logical block exist. |
| 2CH | ERASE (10) | Execute erase operation from the specified logical block address by checking the error correction code. |
| 2EH | WRITE AND VERIFY (10) | Write data to the medium and then verify the written data by checking the error correction code. |
| 2FH | VERIFY (10) | Verify the data starting from the specified logical block address by checking the error correction code. |
| 34H | PRE-FETCH | Transfer the data starting from the specified logical block address to the cache memory. |
| 35H | SYNCHRONIZE CACHE | Synchronize the data on the cache buffer to the medium |
| 37H | READ DEFECT DATA (10) | Read the medium defect information. |
| 3BH | WRITE BUFFER | Write data to the data buffer of the SMO-F531. |
| 3CH | READ BUFFER | Read data from the data buffer of the SMO-F531. |

**GROUP 2 (10-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 40H | CHANGE DEFINITION | Modify medium or drive unit parameters. |
| 55H | MODE SELECT (10) | Set medium or drive unit parameters. |
| 5AH | MODE SENSE (10) | Read medium and drive parameters. |

**GROUP 5 (12-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| A8H | READ (12) | Read data from the specified logical block address. |
| AAH | WRITE (12) | Write data to the specified logical block address. |
| ACH | ERASE (12) | Execute erase operation from the specified logical block address. |
| AEH | WRITE AND VERIFY (12) | Write data to the medium and then verify the written data by checking the error correction code. |
| AFH | VERIFY (12) | Verify the data starting from the specified logical block address by checking the error correction code. |
| B7H | READ DEFECT DATA (12) | Read the medium defect information. |

**GROUP 6 (10-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| DEH | READ LONG | Read data from the specified logical block address with ECC data. |
| DFH | WRITE LONG | Write data to the specified logical block address without using the ECC generation circuitry. |

## SCSI-1 Commands

The SMO-F531 supports the following group 0, group 1 and group 2 commands under Sony SCSI-1 operating definition (upper 3 bits of the operation code is called group code).

**GROUP 0 (6-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 00H | TEST UNIT READY | Provide a means to check whether the logical unit is ready. |
| 01H | REZERO UNIT | Move the optical head to the physical track 0. |
| 03H | REQUEST SENSE | Request the detailed error information. |
| 04H | FORMAT UNIT | Initialize the medium. |
| 07H | REASSIGN BLOCKS | Reassign the defective sectors. |
| 08H | READ | Read data from the specified logical block address. |
| 09H | ERASE | Execute erase operation from the specified logical block address. |
| 0AH | WRITE | Write data to the specified logical block address. |
| 0BH | SEEK | Move the optical head to the physical track where the specified logical block exists. |
| 12H | INQUIRY | Read the information related to the SMO-F531. |
| 15H | MODE SELECT | Set medium or SMO-F531 parameters. |
| 16H | RESERVE | Gain the exclusive control of a specified logical unit. |
| 17H | RELEASE | Release a specified logical unit from the reservation state. |
| 1AH | MODE SENSE | Read medium and SMO-F531 parameters. |
| 1BH | START/STOP UNIT | Start or stop rotating the medium, and/or eject the medium from the SMO-F531. |
| 1CH | RECEIVE DIAGNOSTIC RESULTS | Request analysis data to be sent to the initiator. |
| 1DH | SEND DIAGNOSTIC | Request the SMO-F531 to perform diagnostic tests. |
| 1EH | PREVENT/ALLOW MEDIUM REMOVAL | Prevent or allows removal of the medium in the logical unit. |

**GROUP 1 (10-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 25H | READ CAPACITY | Read the capacity of the medium. |
| 28H | READ | Read data from the specified logical block address. |
| 29H | ERASE | Execute erase operation from the specified logical block address. |
| 2AH | WRITE | Write data to the specified logical block address. |
| 2BH | SEEK | Move the optical head to the physical track where the specified logical block exist. |
| 2CH | ERASE | Execute erase operation from the specified logical block address. |
| 2EH | WRITE AND VERIFY | Write data to the medium and then verify the written data by checking the error correction code. |
| 2FH | VERIFY | Verify the data starting from the specified logical block address by checking the error correction code. |
| 37H | READ DEFECT DATA | Read the medium defect information. |
| 3BH | WRITE BUFFER | Write data to the data buffer of the SMO-F531. |
| 3CH | READ BUFFER | Read data from the data buffer of the SMO-F531. |
| 3EH | READ LONG | Read data from the specified logical block address with ECC data. |
| 3FH | WRITE LONG | Write data to the specified logical block address without using the ECC generation circuitry. |

**GROUP 2 (10-Byte Commands)**

| Code | Description | Function |
|---|---|---|
| 40H | CHANGE DEFINITION | Modify medium or drive unit parameters. |

# Chapter 6. MEDIA FORMAT

This section describes the various media format parameters that the SMO-F531 complies with and supports. The SMO-F531 complies with rewritable optical disk defined by the ISO/IEC 10089 format A, and the ISO/IEC 13549. For a complete description of the media format standard, refer to "ISO/IEC 10089: 1991 (E), Format A, 130 mm rewritable Optical Disk Cartridges for Information Interchange" and "ISO/IEC 13549 Data Interchange on 130 mm Optical Disk Cartridges -Capacity = 1.3 Gbytes per Cartridge-".

## Formatted Zone

The formatted zone of the media extends from radius 29.00 mm to radius 61.00 mm and is divided as shown below. Dimensions are given as references only, and are nominal locations.

**Table 6.1: Formatted Zone**

| Zone | Nominal Radius (mm) |
|---|---|
| Formatted Zone | 29.00 to 61.00 |
| Control Track PEP Zone | 29.00 to 29.50 |
| Transition Zone for SFP | 29.50 to 29.52 |
| Control Track SFP Zone | 29.52 to 29.81 |
| Media Manufacturer Zone | 29.81 to 30.00 |
| - Guard Band | (29.81 to 29.85) |
| - Manufacturer Test Zone | (29.85 to 29.96) |
| - Guard Band | (29.96 to 30.00) |
| User Zone | 30.00 to 60.02 |
| Manufacturer Zone | 60.02 to 60.14 |
| Control Track SFP Zone | 60.14 to 60.50 |
| Lead Out Zone | 60.50 to 61.00 |

# Modulation Code

The SMO-F531 implements RLL (2,7) as the modulation code, adopting pit-position as the recording method of the RLL (2,7) code. The RLL (2,7) code translation is shown in the table below.

**Table 6.2 : Modulation Code**

| Data bits | Channel bits |
|---|---|
| 10 | 0100 |
| 010 | 100100 |
| 0010 | 00100100 |
| 11 | 1000 |
| 011 | 001000 |
| 0011 | 00001000 |
| 000 | 000100 |

# Sector Format

Figures 6.2 and 6.3 show the sector formats for 1024 and 512 bytes/sector format disk, respectively. The ID field contains the preformatted triple ID's. The data field contains 1024 bytes or 512 bytes of user data. Each signal in the said format(s) is defined throughout this section as explained below.

## SECTOR MARK (SM)

The Sector Mark is 5-byte long, and is used for detecting a sector header. The Sector Mark pattern is shown below, where T corresponds to the time length of one channel bit. The single obtain from a mark is less than a single obtained from no mark. The long mark pattern is followed by the channel bit pattern: 0000010010.

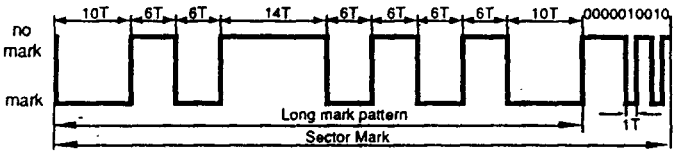


Fig. 6.1: Sector Mark Pattern

### VRIABLE FREQUENCY OSCILLATOR signal (VFO)

VFO consists of three areas designated $VFO_1$, $VFO_2$, and $VFO_3$. $VFO_1$ and $VFO_3$ are 12-byte long and $VFO_2$ is a 8-byte long. VFO is used for the synchronizing the PLO (Phase Locked Oscillator) with the read out signal. The continuous channel bit pattern for the VFO areas is as follows:

$VFO_1$: 192 Channel bits = 0 1 0 0 1 0 0 1 0 0 1 ... 0 1 0 0 1 0

$VFO_2$: 128 Channel bits = 1 0 0 1 0 0 1 0 0 1 0 ... 0 1 0 0 1 0 or

$VFO_2$: 128 Channel bits = 0 0 0 1 0 0 1 0 0 1 0 ... 0 1 0 0 1 0

$VFO_3$: 192 Channel bits = 0 1 0 0 1 0 0 1 0 0 1 ... 0 1 0 0 1 0

### ADDRESS MARK (AM)

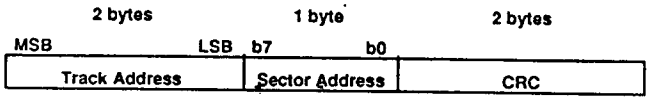
The Address Mark is 1-byte long and used for detecting ID field(s). AM is a channel bit pattern not used in RLL (2,7) and is a run-length violation for RLL (2,7).

The 16-bit channel bit pattern: 0 1 0 0 1 0 0 0 0 0 0 0 0 1 0 0

### IDENTIFICATION (ID) + CYCLIC REDUNDANCY CHECK ( CRC)

The ID consists of 2 bytes of a track address and 1 byte of a sector address followed by 2 bytes of ID field check bytes (CRC) as shown below.

The 2-byte CRC code is used for detecting an ID failure. The MSB (most significant bit) of the track address is output first.




**b0-b4:** Sector Number (0 to 16, or 30)

**b5:** 0 (Reserved)

**b6, b7:** ID number (ID0 to ID2)

The 2-byte CRC checks the track and sector numbers. The codes are generated using the CCITT polynomial $G(X) = X^{16} + X^{12} + X^5 + 1$. The initial value of the CRC resister is all ONEs.

**Postamble(PA)**

The Postamble consists of 1 byte to allow the last byte of CRC to achieve closure of a few uncertain bits in the (2,7) RLL encoding scheme.

**Offset Detection Flag (ODF) & Gap**

The Offset Detection Flag and Gap area contains the bytes explained below. Refer to Fig. 6.2 and 6.3 for the actual layout.

**ODF**

1 byte of mirror area with neither grooves nor preformatted data. (No existence on User Band of ISO/IEC 13549)

**Flag**

5 bytes of the Flag area to prevent inadvertent write operations over previously written data. The SMO-F531 does not use this area to maintain consistent with its rewritable operations capability.

**ALPC (Automatic Laser Power Control)**

This area is designated as a test area for laser power level calibrations.

**Gap**

3-byte long area to absorb the timing shift when writing a Flag.

**Synchronization (SYNC)**

The 3-byte long Synchronization area is used to give the data separation timing for the succeeding data field.

redundant sync pattern for data (triple sync pattern)

0100 0010 0100 0010 0010 0010 0100 0100 1000 0010 0100 1000

Data Field

**For 1024 bytes/sector format disks:**

The data field consists of 1024 bytes of use data and 223 bytes of CRC, ECC and Resync, plus 12 bytes of control information (DMP). See Figure 6.4: "1024 Bytes/sector Data Block Configuration" in the "Data Field Format" section for the data format.

**For 512 bytes/sector format disks:**

The data field consists of 512 bytes of user data, 124 bytes of CRC, ECC and Resync, 2 bytes of received data (FFH), plus 12 bytes of control information (DMP). See Figure 6.5: "512 Bytes/sector Data Block Configuration" in the "Data Field Format" section for the data format.

**Resynchronization Mark (RESYNC)**

The purpose of the RESYNC marks is to prevent the loss of byte synchronization when the VFO must ride through defects within a data field and to limit the propagation of errors. The RESYNC consists of 1-byte pattern (16 channel code bits) of illegal RLL (2,7) modulation code.

The one byte pattern channel code is as follows:

0 0 1 0  0 0 0 0  0 0 1 0  0 1 0 0

Buffer

The Buffer consists of a total of 20 (1024 bytes/sector) or 15 (512 bytes/sector) bytes of received space to allow for motor speed and other electrical/mechanical tolerance.

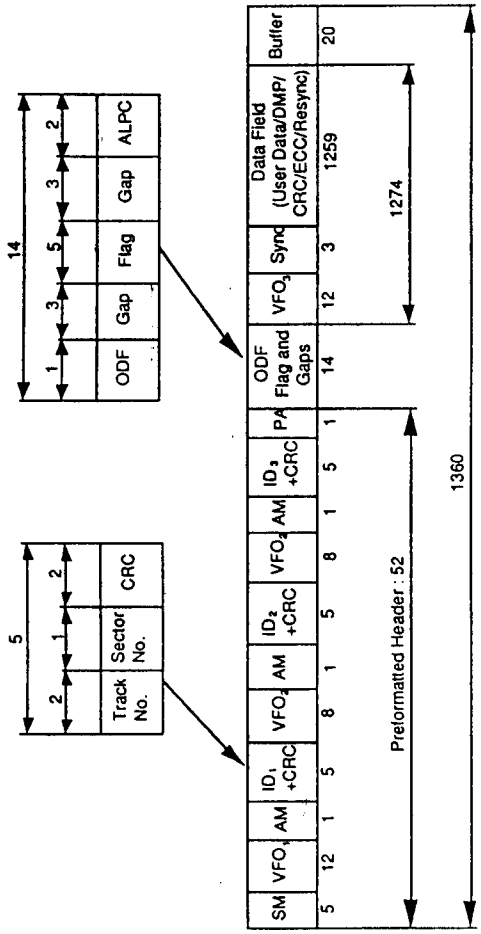



Fig. 6.2: Sector Format of 1024 Bytes/Sector

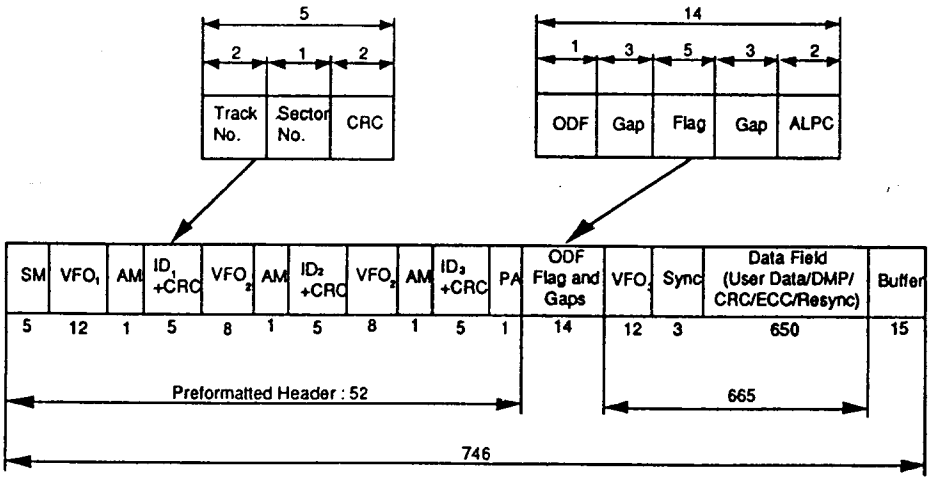



Fig. 6.3: Sector Format of 512 Bytes/Sector

## Data Field Format

The data field of each 1024 bytes/sector and 512 bytes/sector format are as follows;

**Table 6.3: Data Field Format**

| Data Field | 1024 bytes/sector | 512 bytes/sector |
|---|---|---|
| User Data | 1024 bytes | 512 bytes |
| Control Information | 12 bytes | |
| CRC Data | 4 bytes | |
| EDAC* Data | 160 bytes | 80 bytes |
| Reserved Data | 0 byte | 2 bytes |
| RESYNC Pattern | 59 bytes | 40 bytes |

EDAC*: Error Detection and Correction

In case of 1024 bytes/sector, the 10-way interleave is adopted for increased error correction capability. The 5-way interleave is adopted in 512 bytes/sector. Figure 6.4 and 6.5 show the each data configuration.

The EDAC method used for this drive is the Reed-Solomon code, known as Long Distance Code (LDC), with a degree of redundancy of 16. The ECC (Error Correction Code) polynomial expression is as follows;

Primitive Polynomial:

$$G_p(x) = x^8 + x^5 + x^3 + x^2 + 1$$

Element:

$$\alpha^i = (\beta^i)^{88}$$

where $\beta$ is the root of $G_p(x)$

Generator Polynomial:

$$G(x) = \prod_{i=120}^{i=135} (x+\alpha^i)$$

The initial set value of the ECC register is all ZEROs. The ECC data output to the media is inverted from the calculated data.

The 4-byte CRC is calculated over the data field, including the control data. The same primitive polynomial as the ECC calculation is used. The CRC generator polynomial is as follows:

$$G(x) = \prod_{i=136}^{i=139} (x+\alpha^i)$$

Initial set value is all ZEROs. Input sequence is MSB to LSB. Output value to the media is not inverted from the calculated data.

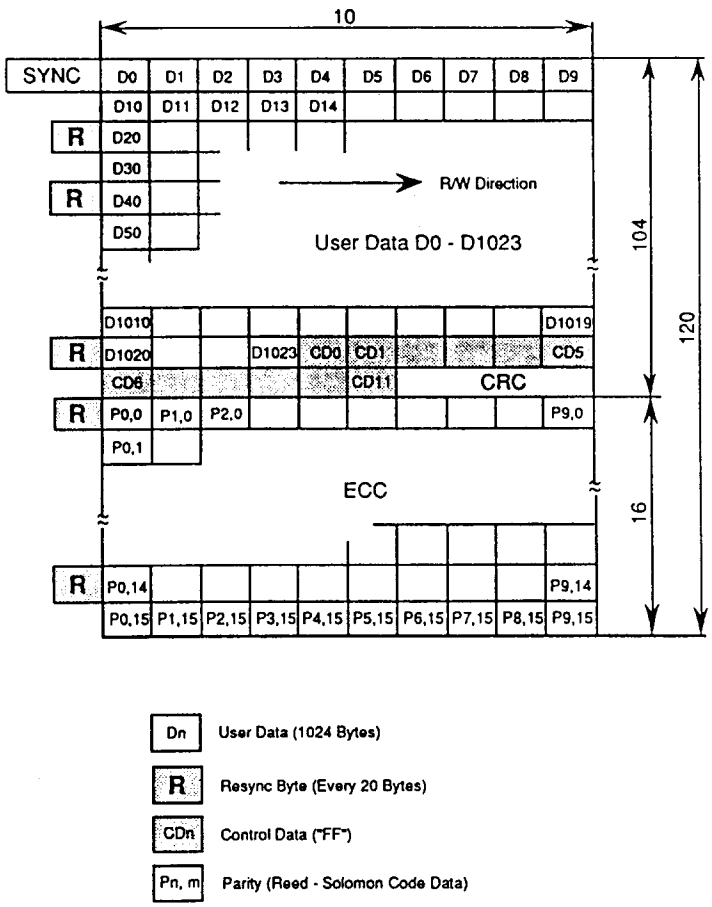






**Fig. 6.4 : 1024 Bytes/Sector Data Block Configuration**

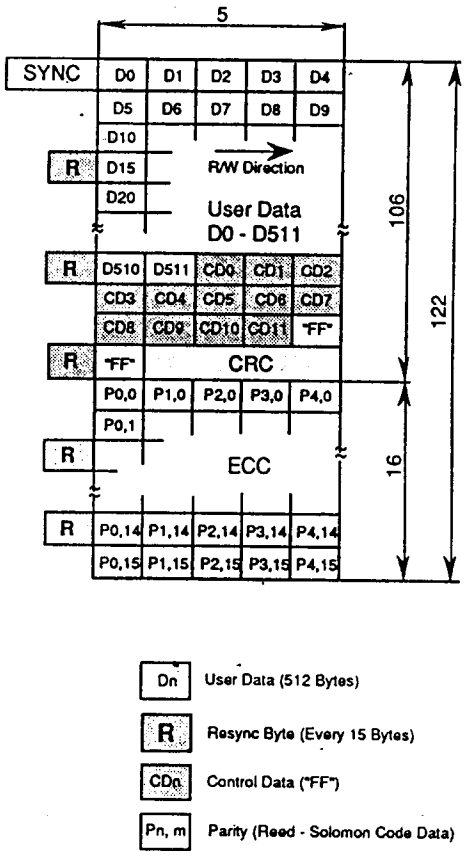






Fig. 6.5 : 512 Bytes/Sector Data Block Configuration

# Chapter 7. PRECAUTIONS

## Drive Handling Precautions

- Operating environment is complied with "Installation Requirements".
- Be sure to use only DC +5V ±5% and +12V ±5% .
- Do not subject the drive to shock and vibration.
- Inserting a disk cartridge into the mechanism when moisture is present may cause damage to both the disk and the drive.

## Disk Handling Precautions

- Do not drop the disk or bump it against other object.
- The disk cartridge's shutter automatically opens when it is inserted in the drive. Do not open the shutter manually or touch the disk inside.
- Do not disassemble the disk cartridge. Precise adjustments are made at the factory prior to shipping.
- Erase protection tabs are provided on the disk cartridge. To protect data recorded on the disk, slide the red tab in the direction of the arrow; to unlock the protection, slide the tab in the opposite direction.

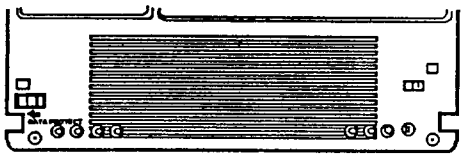


**Fig. 7.1: Erase Protection Tab**

- Moisture condensation caused by a sudden temperature change or high humidity may impair writing or reading capabilities.

**Notes on storage:**

- Store cartridges in their case.
- Keep cartridges away from heat sources, such as radiators, or places subject to direct sunlight, excessive dust and/or moisture.

# Cleaning

## Cleaning the Lens

In order to avoid data errors which may be caused by dust accumulate inside the unit, the drive's optical lens must be cleared periodically.

For cleaning, use the separately sold lens cleaning cartridge(Sony model number: MOA-L55/2). This lens cleaning cartridge is simply inserted into the drive for 4 to 5 times to clean the lens. Cleaning at least once a month is highly recommended. Cleaning must be performed while the power is turned off. For more information on lens cleaning procedures, refer to the MOA-L55/2 user's manual.

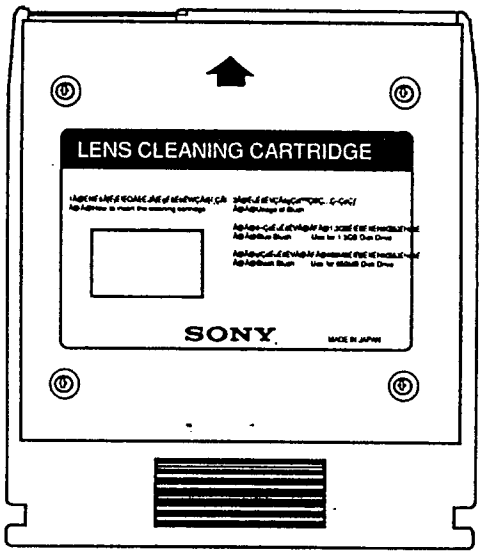



Fig. 7.2: MOA-L55/2

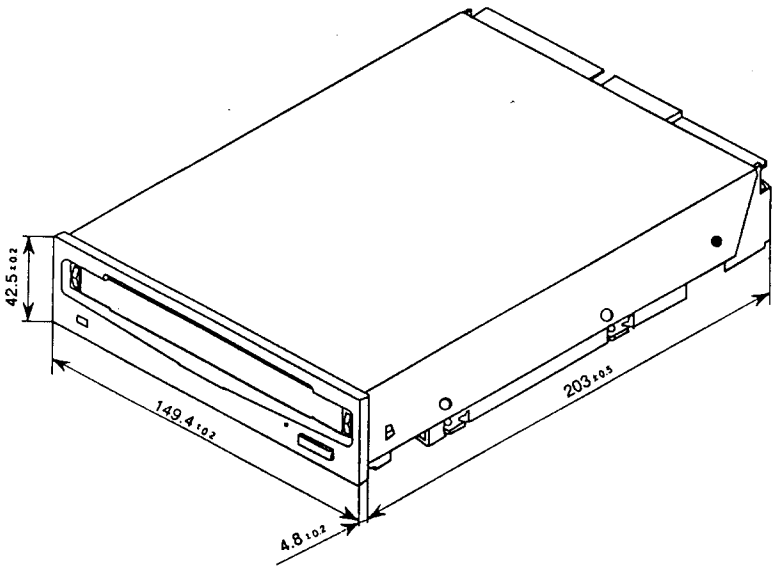
## Cleaning Disks

Dust and stains may accumulate on magneto-optical disks when they are used for a long period of time. To avoid resultant data read/write errors, use an optional disk cleaner. For cleaning, use the separately sold disk cleaning kit(Sony model number: MOA-D51) or auto disk cleaner(Sony model number: MOA-D55/2). To maintain the high performance and prolong the useful life of your MO disk, cleaning at least once every three months is recommended. For more information on disk cleaning procedures, refer to each user's manual.

## Appendix-1

**Mechanical Dimensions (Overview)**

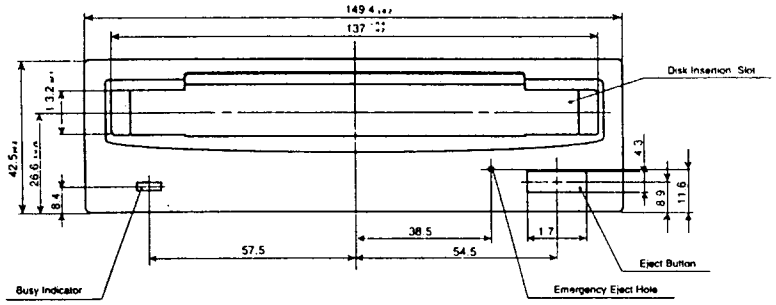
All dimensions are shown in mm.



## Appendix-2

**Mechanical Dimensions (Front View)**

All dimensions are shown in mm.



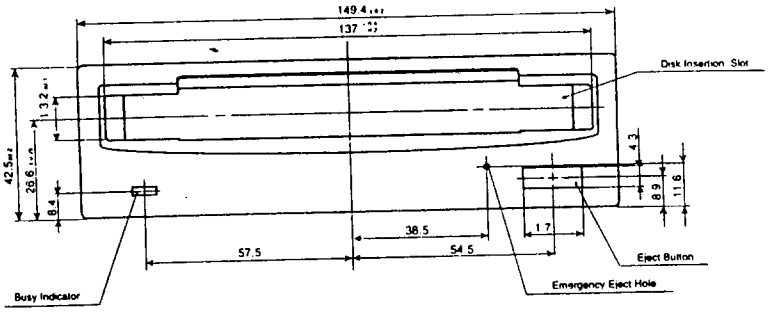

**NOTES:**

1. The eject button protrudes from the front panel by 2 mm.
2. The disk insertion slot is centered with respect to the front panel.

## Appendix-2

**Mechanical Dimensions (Front View)**

All dimensions are shown in mm.



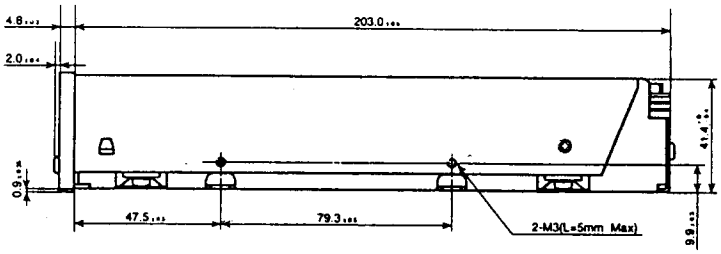

**NOTES:**

1. The eject button protrudes from the front panel by 2 mm.
2. The disk insertion slot is centered with respect to the front panel.

## Appendix-3

**Mechanical Dimensions (Side View)**

All dimensions are shown in mm.



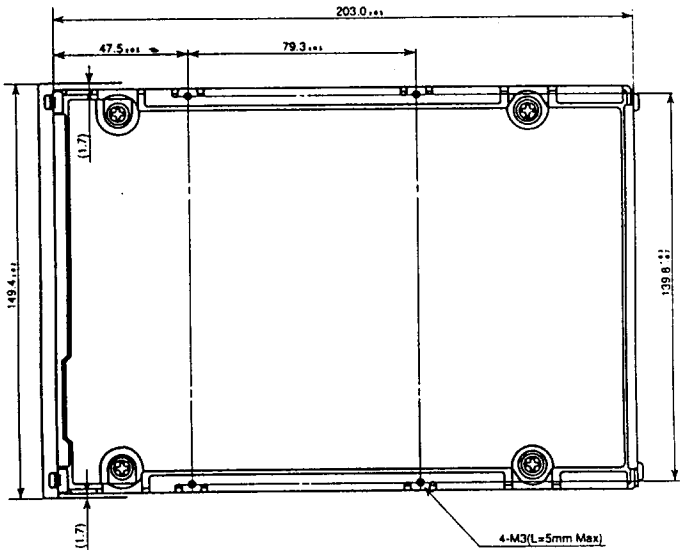

**NOTES:**

1. The interface connectors protrude from rear panel of the drive.
2. The four(4) M3 taps are provided to stabilize the position of the mounted drive.
   (**CAUTION**: The length "L" must be kept to less than 5 mm.)

## Appendix-4

**Mechanical Dimensions (Bottom View)**

All dimensions are shown in mm.



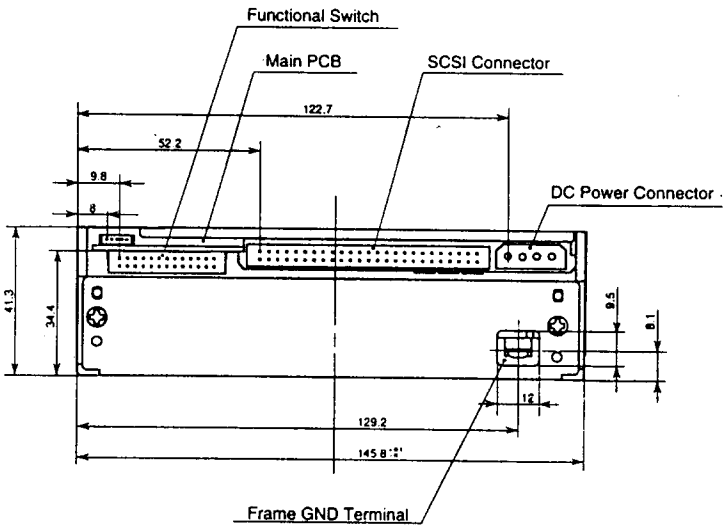

**NOTES:**

1. The four(4) M3 taps are provided to stabilize the position of the mounted drive.
   (**CAUTION**: The length "L" must be kept to less than 5 mm.)
2. The front panel and the mounting holes on the bottom are centered with respect to the chassis.

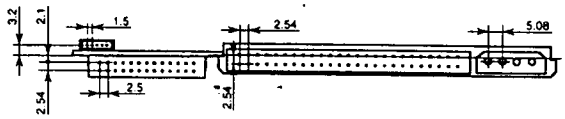
## Appendix-5

**Mechanical Dimensions (Rear View)**

All dimensions are shown in mm.



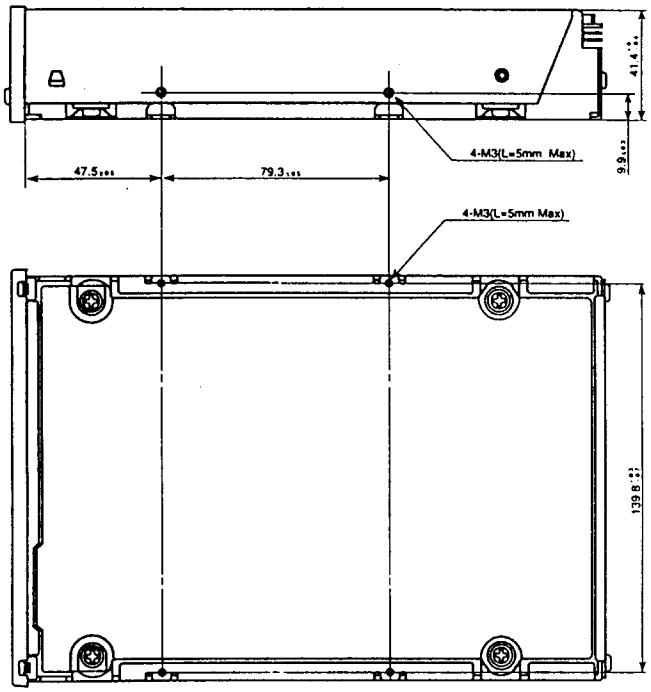

Main PCB



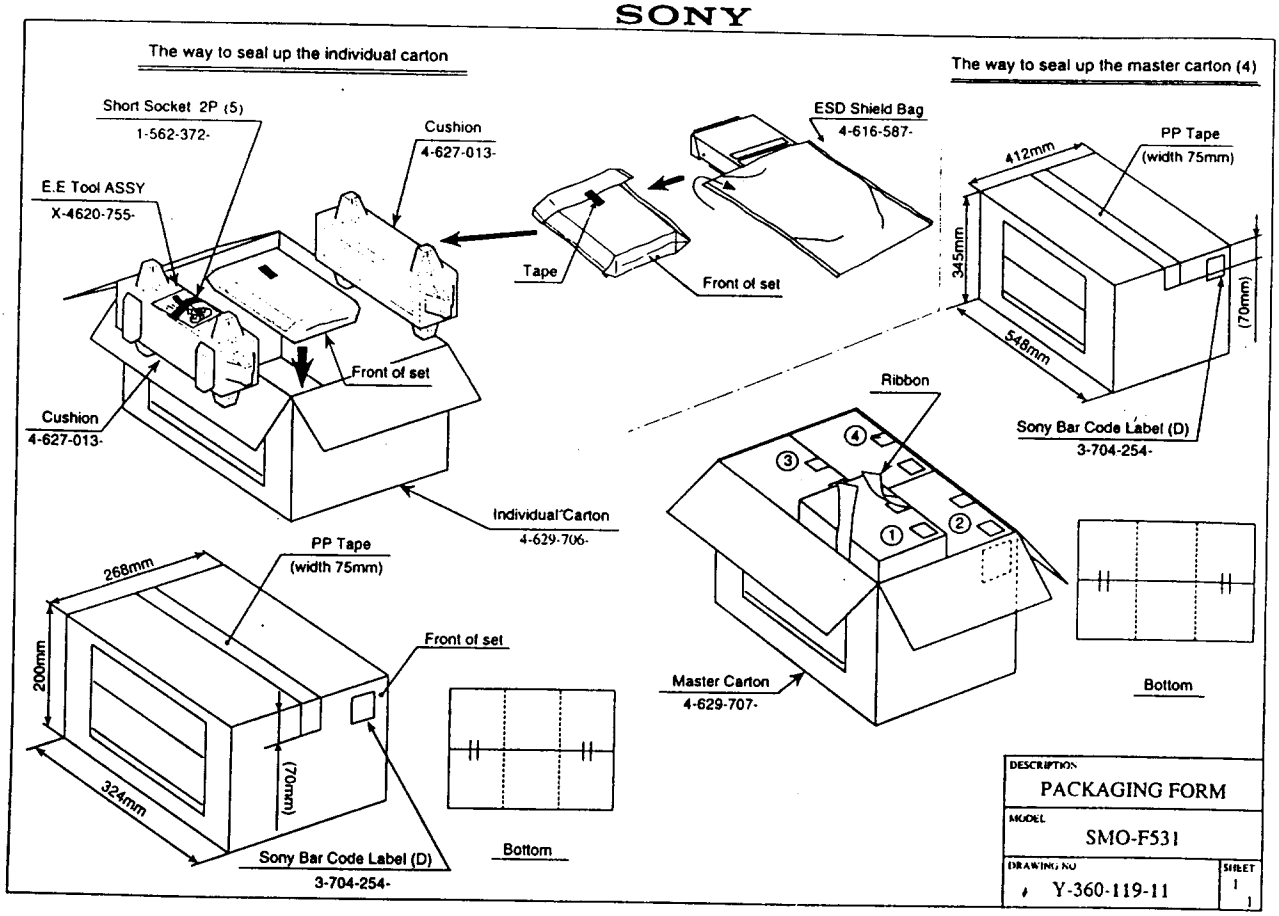
## Appendix-6

**Mechanical Dimensions (Mounting)**

All dimensions are shown in mm.



SONY


The way to seal up the individual carton
Short Socket 2P (5)
1-562-372-
Cushion
4-627-013-
E.E Tool ASSY
X-4620-755-
ESD Shield Bag
4-616-587-
Tape
Front of set
Front of set
Cushion
4-627-013-
Individual Carton
4-629-706-
The way to seal up the master carton (4)
PP Tape
(width 75mm)
412mm
345mm
548mm
(70mm)
Sony Bar Code Label (D)
3-704-254-
Ribbon
Master Carton
4-629-707-
Bottom
PP Tape
(width 75mm)
268mm
200mm
Front of set
324mm
(70mm)
Sony Bar Code Label (D)
3-704-254-
Bottom
DESCRIPTION
PACKAGING FORM
MODEL
SMO-F531
DRAWING NO
Y-360-119-11
SHEET
1
1
ISSUED '95. 3. 2

SMO-F531

# Magneto-Optical Disk Drive

Technical Guide and Specifications

Sony Corporation

3-800-228-11(1)